MSE Wall Detailing Requirements & Working Drawings

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Origins

In the past few years, there have been several complaints from industry regarding the quality and accuracy of information shown on the plans for MSE walls.

Origins

In response to industry's complaints the INDOT Retaining Wall Committee proposed revisions to the MSE Retaining Wall provisions (Specifications and the Design Manual).

Origins

MSE Retaining Walls are still essentially a design-build type of item contained within a contract. The plans show the length and height of the wall and it is up to the contractor to perform the detailed design and provide a product that meets the required dimensions.

Origins

The designer is still responsible for showing a three-line drawing on the plans and providing an estimated quantity for structure and B Borrow backfill and face panels, leveling pad, and wall erection.

Recent Changes

Specifications

- The longstanding 731-R-202 recurring special provision is now in the *Standard Specifications* as section 731.

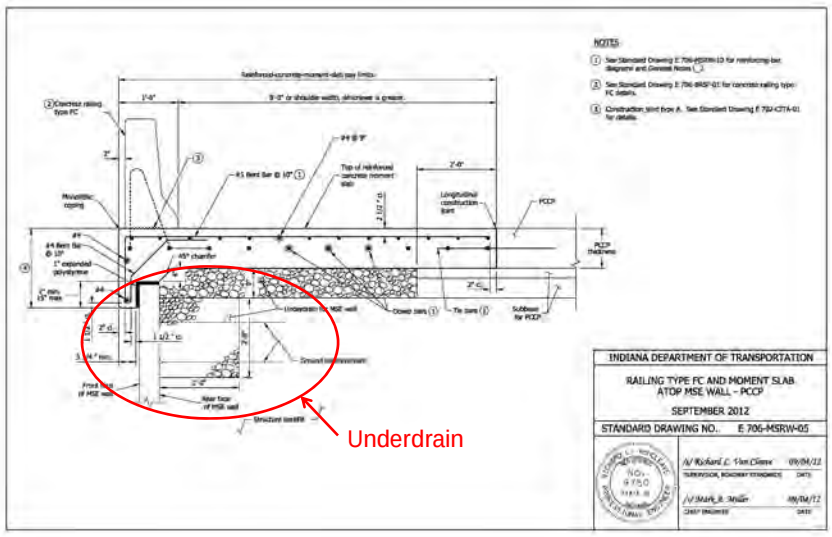
- The contractor is no longer allowed to use No. 30 size material (commonly referred to as "sand")

Recent Changes

- The same structure backfill material must be used for the entire wall volume.

- 731.11 and 718.03(b) describe underdrains used within the limits of MSE walls. Standard Drawing 706-MSRW-01 thru -08 show the underdrain used for MSE walls.

Recent Changes



Recent Changes

- Added service life requirements.
  - Generally it is 75 years.
  - Where the wall supports a spread footing for a bridge, it is 100 years.
- Updated the specification to reference LRFD. Minimum ground reinforcement length is no longer specified as 0.7H or 8 ft minimum.

Recent Changes

- The specification better defines what the owner will be designing
  - External Stability
    - Applied bearing pressure
    - Overturning check
    - Sliding check
    - Stability of temporary construction slopes (only if shown in Contract plans, i.e. phased construction).
- The contractor is responsible for internal stability

Recent Changes

- New recurring special provision 731-R-597 has spec requirements that resulted in design memorandum 12-08.

- This provision defined the design height to be used in internal stability calculations.

Recent Changes

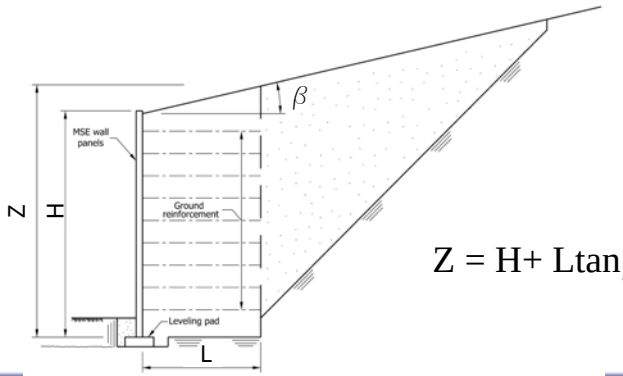
- The RSP states that the contractor determines the final leveling pad layout and step elevations that provide the wall envelope shown on the plans.

Recent Changes

Design Changes (Design Memo 12-08)

- Design height has been corrected and clarified.

Design manual figure 410-5(0)A shows a graphical version.



$$Z = H + L\tan\beta$$

Recent Changes

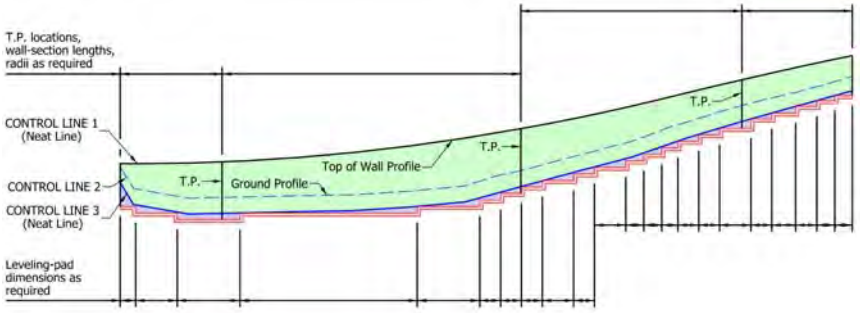
- Defined a minimum distance below the existing or proposed ground line where the top of the leveling pad is located:
  - 2 ft (or whatever depth is recommended in the Geotechnical Report.)
- Defined leveling pad step increments and face panel dimensions:
  - 2.5 ft step increments
  - 10 ft length x 5 ft height x 6 in. thickness (9 in. thickness for decorative panels)

Recent Changes

- Neat Lines
  - Control Lines 1 and 3 are also supposed to be labeled as neat lines.
  - Common excavation limits are also supposed to be labeled as neat lines.
- This ties the plans to the method of measurement and basis of payment sections of the specification.

Recent Changes

- Quantities
  - The resulting area (wall envelope) measured between control lines 1 and 3 is the pay quantity and should be used in the schedule of pay items.



Recent Changes

- Wall Quantities
  - The area below control line 3 and the top of the leveling pad is conceptual and not included in the pay quantity. The designer can add a note to the plan sheets informing the bidders of the quantity of the conceptual area.
  - The pay unit is in square feet.

Recent Changes

- Backfill Quantities
  - Quantities for Structure Backfill, Type 3 and B borrow should be calculated as they have always been, from the bottom of the leveling pad elevation the designer has assumed to the top of the wall.
  - After deducting for overlapping areas, the resulting quantity is the pay quantity.

Recent Changes

- Reminder:

  Aside from the top of wall elevation, everything else associated with MSE wall detailing on the plans is conceptual in nature. Depending on the wall system supplier, the assumptions the designer has made and the conceptual information shown on the plans may be very accurate or not.

Recent Changes

- Suggested Note on Plans:

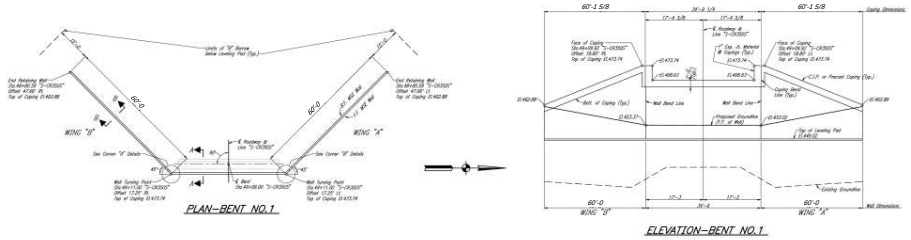
  "The leveling-pad, leveling-pad step locations, elevations, and dimensions, and resulting structure backfill and B borrow backfill quantities are conceptual and are provided for information only. The Contractor shall be responsible for the quantity on which it bases its bid."

New Policy Impact on Designers

- MSE Details
- Quantities
- Geotechnical Engineer
- Shop Drawing Engineer/Contractor

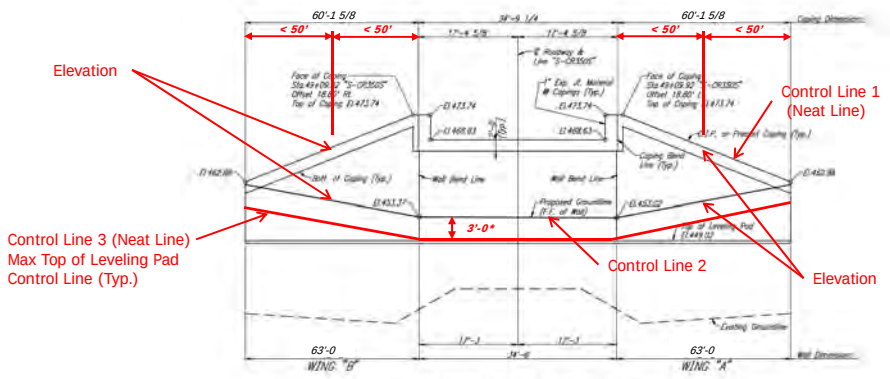
New Policy Impact on Designers

MSE Details



New Policy Impact on Designers.

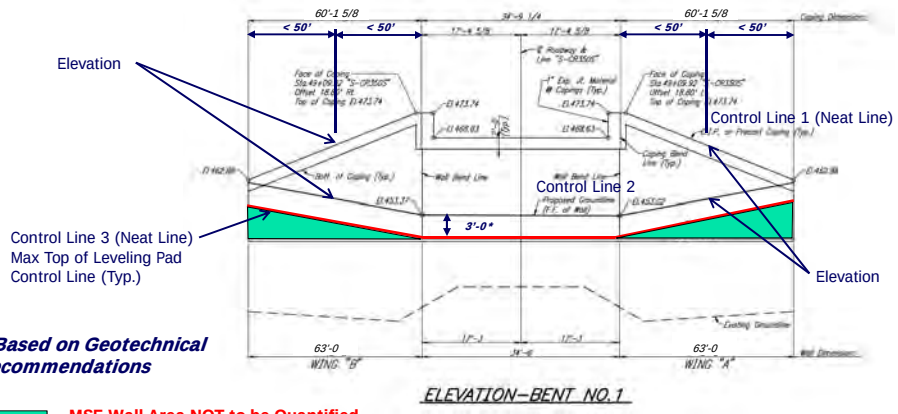
MSE Details - Values in Red due to Memo



**** Based on Geotechnical Recommendations***

New Policy Impact on Designers

Quantities

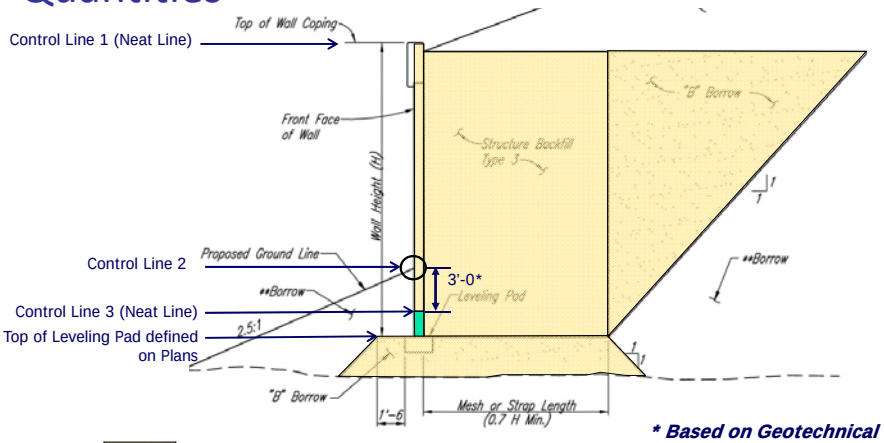


**** Based on Geotechnical Recommendations***

MSE Wall Area NOT to be Quantified.
(B Borrow and Structure Backfill still to be quantified to given Leveling Pad Elevation)

New Policy Impact on Designers

Quantities



Area to be Quantified.

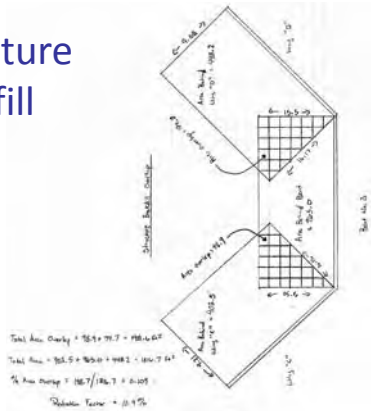
Area NOT to be Quantified.

**** Based on Geotechnical Recommendations***

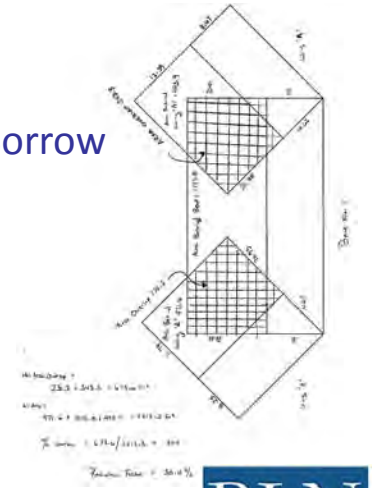
New Policy Impact on Designers

Quantities – Overlapping Areas

Structure Backfill



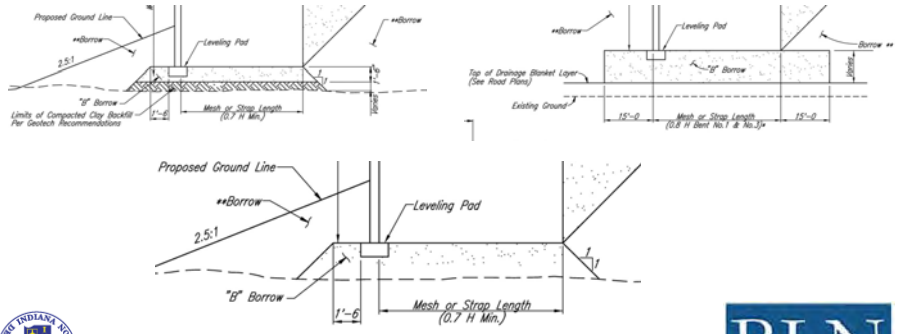
B Borrow



New Policy Impact on Designers

Geotechnical Engineer

- Clearly Define Mitigation – Shape and Material – Varies by site and Geotechnical Engineer



New Policy Impact on Designers

Geotechnical Engineer

- Frost Line - LRFD [11.10.2.2] states no need to replace material not susceptible to frost (i.e. rock)
- Memo defines Design Wall Height – Should be unchanged by Memo

New Policy Impact on Designers

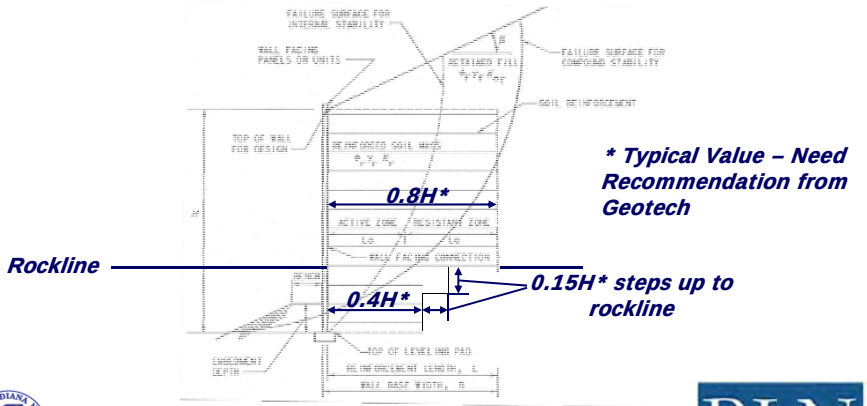
Geotechnical Engineer

- Supply Geotechnical Engineer Additional Loads – Sign and Light Supports, etc.

New Policy Impact on Designers

Geotechnical Engineer

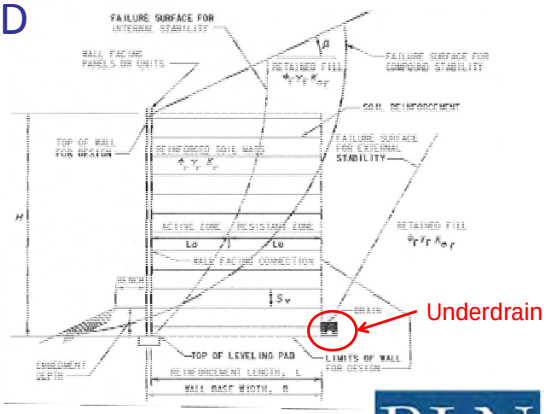
- Rock



New Policy Impact on Designers

Common Problems

- Underdrain Location – LRFD Fig 11.10.2-1

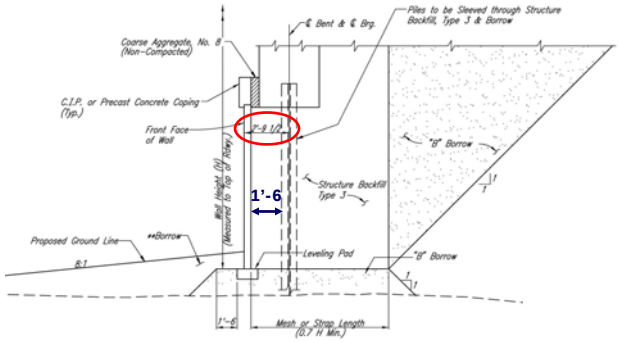


BLN

New Policy Impact on Designers

Common Problems

- MSE Abutments – LRFD 11.10.11 – Min Clear Distance of 1’-6”



BLN

New Policy Impact on Designers

Shop Drawing Engineer/Contractor

- Needs to determine most efficient way to build wall (Labor and Materials)
- Needs to have an idea of the required extra material prior to bid

MSE Wall Working Drawings

- Responsibility
  - Construction Memorandum 11-02 indicates that the MSE working drawings and design calculations be submitted to the designer of record. These calculations must be signed and sealed by a registered professional engineer.

MSE Wall Working Drawings

- Amount of review is up to the Reviewer and their Company's Policy
- There is a minimum amount of information that INDOT prefers to be reviewed
- Hierarchy
  - Tier 1 – Should be Verified
  - Tier 2 – Cursory Review
  - Tier 3 – At Your Discretion

MSE Wall Working Drawings

- Before reviewing working drawings, it is recommended that the designer meet with their management personnel and discuss the depth and magnitude of review that their particular firm requires.

MSE Wall Working Drawings

Tier 1 – Should be verified

- Top of wall elevations
- Turning point locations
- Begin and end of wall stations and offsets
- Length of Ground Reinforcement in plans and computations versus wall height (also check against Geotechnical Report)

MSE Wall Working Drawings

Tier 1, cont. – Should be verified

- Depth of Leveling Pad
- Location and elevation of any appurtenances
- Bearing pressures not exceeded
- Correct Architectural Treatment specified

MSE Wall Working Drawings

- Tier 2 – Cursory Review
  - Material Data on General Notes and calculations
  - Dimensions and Reinforcement in CIP Coping
  - Section views match Contract Plans
  - Assumptions in calculations and correct AASHTO Design Code (LRFD vs. LFD - including seismic variables and surcharge)

MSE Wall Working Drawings

- Tier 3 – At your discretion
  - Panel Details
  - Coping Length
  - Calculations result in acceptable design

Questions